Department of Finance & Administration | Strategic Technology Solutions

Tennessee Division of Strategic Technology Solutions

NASCIO Category: **Data Management, Analytics & Visualization**
Project Title: **Hurricane Helene Geospatial Response**
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Executive Summary

On September 27, 2024, eastern Tennessee was devastated by Hurricane Helene. Rivers changed course, communities were flooded, lives were lost, homes and property were destroyed, and roads, bridges, businesses, and critical infrastructure sustained catastrophic damage.

From initial response through ongoing recovery, Tennessee's Strategic Technology Solutions Center for Enterprise Data and Analytics enterprise GIS team led a coordinated, geospatial data-driven response to this disaster. In an emergency of this scale, location was critical. Decision-makers needed to understand where damage occurred, which infrastructure was compromised, where roads were closed, how conditions changed over time, and how resources should be prioritized.

The enterprise GIS team rapidly coordinated authoritative geospatial data from key partners, including the Tennessee Emergency Management Agency (TEMA), Federal Emergency Management Agency (FEMA), Tennessee Department of Transportation (TDOT), Tennessee Department of Environment and Conservation (TDEC), as well as contractors, and local governments. By integrating these datasets into a unified geospatial response, the team created a common operating picture that supported real-time situational awareness across agencies and jurisdictions.

The team also managed imagery acquisition flights, provided access to critical datasets, and rapidly developed web mapping applications and geospatial services for responders, engineers, planners, local governments, utilities, and the public. These tools transformed complex data into actionable maps and analysis, helping users visualize storm impacts, assess infrastructure conditions, monitor road and bridge reconstruction, estimate soil and vegetation loss, track debris removal, and support ongoing recovery.

Data and applications were centralized and shared through Tennessee's geospatial imagery hub, imagery.tn.gov. The team also coordinated with federal and state partners to collect post-disaster LiDAR elevation data in spring 2025, creating a valuable foundation for change detection, flood modeling, resilient construction, planning, and long-term recovery analysis.

The result is a powerful example of how data management, analytics, and visualization can strengthen government response, cross-agency collaboration, accelerate recovery, and support more informed decisions during one of Tennessee's most destructive natural disasters.

Idea

What problem or opportunity does the project address?
Hurricane Helene created a rapidly changing disaster environment across eastern Tennessee. Roads, bridges, rivers, homes, businesses, utilities, and public infrastructure were damaged or destroyed. The geographic scale and complexity of the disaster required fast, accurate, and shared information. In the immediate aftermath, decision-makers needed answers to urgent questions:

- Where did the greatest damage occur?
- Which roads and bridges were closed, damaged, or under reconstruction?
- Where had rivers changed course or caused new hazards?
- What communities and infrastructure were most at risk?
- Where should response and recovery resources be prioritized?
- How could multiple agencies work from the same trusted data?

Relying on fragmented datasets, inconsistent maps, duplicated imagery, and disconnected situational awareness would have slowed response, complicated recovery planning, and limited the ability of state, federal, and local partners to make informed decisions. The enterprise GIS team created a unified, authoritative geospatial response, integrating data from multiple partners, coordinating imagery collection, building mapping tools, and centralizing access to critical geospatial information.

Why does it matter?
In disaster response, location matters, as responders and decision-makers need to know exactly where it happened, how conditions are changing, and what areas require immediate attention.

Geospatial data helped Tennessee move from isolated reports and static information to dynamic, map-based situational awareness. This allowed agencies to visualize damage, understand regional impacts, coordinate resources, and track recovery over time.

A centralized geospatial response helped users:

- Assess storm damage more quickly
- Monitor road and bridge conditions
- Track reconstruction progress
- Support emergency management operations
- Coordinate among state, federal, and local partners
- Provide accessible information to technical and non-technical users
- Build datasets that continue to support long-term recovery

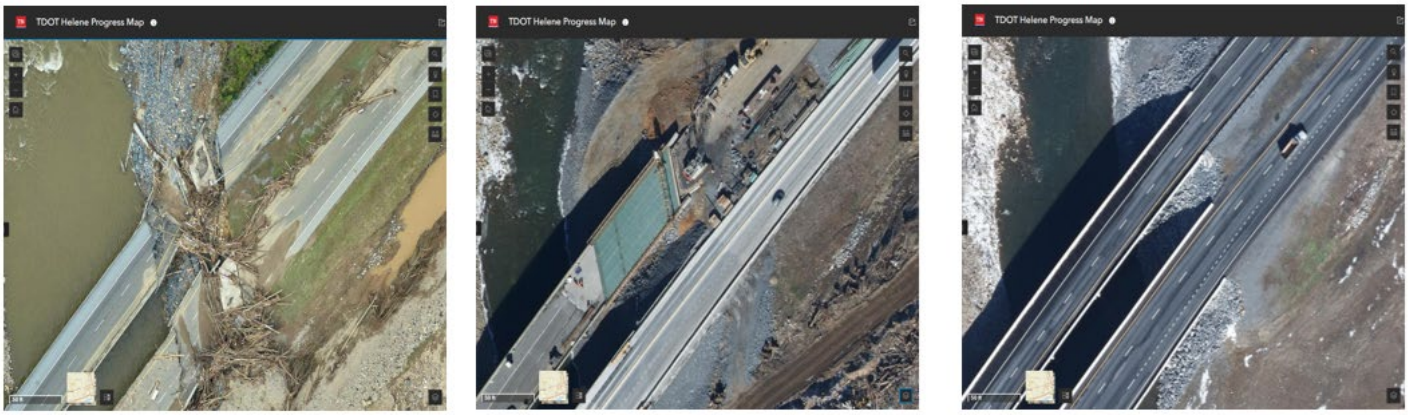
What makes it different?
This project was different because it combined rapid emergency response with enterprise-scale geospatial data management and long-term recovery planning.

The enterprise GIS team coordinated imagery acquisition flights, integrated authoritative datasets, managed data access, developed web mapping applications, supported multiple partner agencies, and established a centralized hub for disaster-related imagery and geospatial services.

The team's applications transformed complex geospatial data into intuitive tools that could be used by both technical and non-technical audiences. This was critical because disaster response involves a

wide range of users, including emergency managers, engineers, planners, local officials, utility providers, contractors, executives, and members of the public.

One example was the TDOT Helene Progress Map, developed for TDOT leadership and engineers to visualize construction progress. The application included weekly imagery flights spanning from October 3, 2024, to February 8, 2026, allowing users to monitor change over time and evaluate recovery progress.



These images above are part of weekly images provided to state leadership to show the progress made on construction between 2024 and 2026. The image on the far left was captured shortly after Helene, while the image on the far right shows the completed project. The middle image is from the time between in 2025,

The project also extended beyond immediate response by coordinating post-disaster LiDAR elevation data collection in spring 2025. This investment created a data foundation for future analysis, including change detection, flood modeling, resilient construction, and planning.

What makes it universal?
Every state faces natural disasters, infrastructure risk, and the need for coordinated emergency response. Whether the threat is flooding, wildfire, severe storms, earthquakes, or other hazards, governments need trusted data and shared situational awareness. This project provides a replicable model for any state seeking to strengthen disaster response through enterprise GIS, shared data platforms, imagery management, and accessible geospatial applications.

Implementation

What was the roadmap?
The roadmap began with the urgent needs created by Hurricane Helene's landfall and continued through long-term recovery planning. The enterprise GIS team first focused on establishing situational awareness. This required identifying impact areas, coordinating with partner agencies, gathering available data, and determining what imagery and mapping services were needed most urgently.

The team then coordinated imagery acquisition flights to capture changing conditions across impacted areas, providing current visual information supporting emergency response, infrastructure assessment, and recovery monitoring.

Next, the team integrated authoritative datasets from key partners, including TEMA, FEMA, TDOT, TDEC, contractors, and local governments, allowing for a unified geospatial response.

The team developed and deployed web mapping applications and services to make the data usable in assessing damage, visualizing infrastructure conditions, monitoring recovery progress, and making decisions based on current geographic information.

As recovery continued, the team expanded the effort by coordinating post-disaster LiDAR data collection in spring 2025. This elevated the project from immediate response to long-term resilience planning.

Assuring buy-in and adoption

Buy-in was secured through urgent operational need, trusted relationships, and usable tools.
Hurricane Helene created immediate demand for accurate location-based information. Agencies and partners needed to understand damage, infrastructure status, road conditions, and recovery progress. The GIS team responded by delivering tools that met real needs in real time.

"*The Helene Response web application allowed TDOT leadership to easily view the imagery in the correct location and make critical decisions regarding road condition and priorities.*" – **Melissa Portell**, TDOT Geodetics Manager

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Adoption was also supported by the team's existing relationships with GIS professional groups, emergency management agencies, 911 communities, local governments, and federal partners. These relationships helped the team communicate quickly, understand user needs, and ensure that geospatial data could be incorporated into multiple operational systems.

The team further supported adoption by designing intuitive web mapping applications. Users did not need to be GIS experts to benefit from the tools. They could visualize impacts, review imagery, monitor progress, and make decisions through accessible applications.

What constitutes success?

The project could be called a success if users could:

- Access current imagery and trusted geospatial data
- Visualize disaster impacts
- Assess infrastructure damage and recovery progress
- Support emergency response decisions
- Coordinate across agencies and jurisdictions
- Monitor road closures, debris removal, construction, and environmental change
- Use the data for both immediate response and long-term recovery planning

The project also succeeded by creating durable value beyond the initial emergency. Weekly imagery, centralized access, web mapping applications, and post-disaster LiDAR data continue to support recovery, analysis, planning, and resilience.

Impact

What did the project make better?
The Tennessee Hurricane Helene geospatial response improved the speed, accuracy, and coordination of disaster response and recovery decisions.

Before	After
Disaster information was at risk of being fragmented across agencies and systems	Authoritative geospatial data was integrated into a unified response
Users needed to interpret complex datasets manually	Web mapping applications turned data into actionable visual intelligence
Imagery access could be inconsistent or difficult to coordinate	Imagery was managed, centralized, and shared through imagery.tn.gov
Agencies could have worked from different maps or assumptions	Partners gained access to shared situational awareness
Infrastructure recovery progress was difficult to visualize over time	Weekly imagery and mapping applications allowed users to monitor change and construction progress
Disaster data could have served only immediate response needs	Post-disaster LiDAR and imagery created long-term value for planning, flood modeling, and resilience

The project made government response more coordinated, data-driven, and transparent. It helped users move from scattered information to shared understanding.

How do we know it is better?
The impact is evident in the range of decisions and activities supported by the geospatial data, applications, and imagery.

Users applied the tools to:

- Perform damage assessments
- Monitor interstate reconstruction
- Map road closures
- Estimate soil and vegetation loss
- Monitor debris removal
- Visualize construction progress
- Support recovery planning
- Share data across state, local, and federal systems
- Inform post-disaster studies

The project also created long-term analytical value through post-disaster LiDAR data collection. Collected in spring 2025, this elevation data will support change detection, flood modeling, planning, resilient construction, and other use cases.

What's the long-term plan?
The long-term plan is to continue using geospatial data, imagery, applications, and LiDAR to support Hurricane Helene recovery and future resilience efforts.

Recovery from a disaster of this scale does not end when the immediate emergency response concludes. Roads, bridges, waterways, communities, and landscapes continue to change. Long-term recovery requires ongoing monitoring, analysis, planning, and coordination.

The imagery and applications developed for Helene will continue supporting post-disaster studies and infrastructure recovery. The post-disaster LiDAR data collected in spring 2025 will provide a critical baseline for future analysis, including flood modeling, resilient construction, environmental assessment, and change detection. The project also strengthens Tennessee's ability to respond to future disasters. The relationships, workflows, applications, and data-sharing practices established during Helene can be reused and improved for future emergency events.

Why is it worth continued investment?
Continued investment in enterprise GIS is essential because geospatial data is foundational to emergency response, infrastructure resilience, and public service delivery.

The Hurricane Helene response demonstrated that authoritative geospatial data, imagery, analytics, and visualization can improve the speed and quality of decisions during a major disaster. It also showed that a centralized enterprise GIS team can connect agencies, reduce duplication, improve data access, and create tools that serve both technical and non-technical users. Continued investment will help Tennessee:

- Maintain readiness for future disasters
- Improve imagery and data coordination
- Expand use of LiDAR and elevation analytics
- Strengthen flood modeling and resilient construction planning
- Support infrastructure recovery and environmental analysis
- Improve collaboration among state, local, and federal partners
- Provide decision-makers with timely, location-based intelligence

This project proves that GIS a mission-critical capability for public safety, disaster recovery, and statewide resilience.